IMPACT EVALUATION OF BPA'S STANDARD OFFER COMMERCIAL LIGHTING PROGRAMS

Final Report

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EXECUTIVE SUMMARY

This report presents and discusses the analysis and results from an evaluation of the impacts and customer satisfaction levels for the Bonneville Power Administration's (BPA) Standard Offer Commercial Lighting Programs. Through this program, participating utilities offer assistance and rebates to commercial and industrial customers in their service territories in making energy efficiency efficient lighting replacements or improvements at their facilities.

The overall objective for this evaluation was to determine the total energy savings, the demand impacts resulting from the programs, and the level of customer satisfaction with the programs. These results are summarized in the following tables. Table ES-1 summarizes program energy savings. The data reported in Table ES-1 provides an overall comparison between the estimates of program-level energy savings developed in this study and expected savings for the Commercial Lighting Programs, as reported in tracking system records. The program achieved over 43 GWh of verified savings through nearly 1,100 individual projects during the 2004-2006 cycles.

- Table ES-2 summarizes program summer and winter peak period energy savings. Summer peak demand is defined as demand between 6 and 9 PM on weekdays. Winter peak demand is defined as demand between 7 and 10 AM on weekdays.
- Table ES-3 presents program impacts on summer and winter peak demand.

Table ES-1. Summary of Energy Savings by Stratum

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Expected kWh Savings*	*Realization Rate*	*Verified kWh Savings*
Certainty	Over 400,000 kWh	13	11,699,400	83.4%	9,752,980
Stratum 1	200,000 – 400,000	26	7,577,756	88.9%	6,738,593
Stratum 2	100,000 – 200,000	48	6,458,132	104.7%	6,759,735
Stratum 3	50,000 – 100,000	88	6,260,873	93.2%	5,837,303
Stratum 4	25,000 – 50,000	147	5,255,403	110.3%	5,794,758
Stratum 5	Under 25,000	775	6,516,853	125.0%	8,148,332
Totals		1,097	43,768,417	98.3%	43,031,701

Table ES-2. Summary of Summer and Winter Peak Program Energy Savings

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Verified Summer Peak kWh Savings*	*Verified Winter Peak kWh Savings*
Certainty	Over 400,000 kWh	13	842,854	936,836
Stratum 1	200,000 – 400,000	26	712,904	789,557
Stratum 2	100,000 – 200,000	48	636,193	963,954
Stratum 3	50,000 – 100,000	88	425,243	880,945
Stratum 4	25,000 – 50,000	147	434,279	888,899
Stratum 5	Under 25,000	775	401,494	1,320,876
Totals		1,097	3,452,968	5,781,067

Table ES-3. Summary of Summer and Winter Peak Demand Reductions by Stratum

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Verified Summer Peak Demand Reduction (kW)*	*Verified Winter Peak Demand Reduction (kW)*
Certainty	Over 400,000 kWh	13	1,099	1,213
Stratum 1	200,000 – 400,000	26	809	938
Stratum 2	100,000 – 200,000	48	729	1,087
Stratum 3	50,000 – 100,000	88	538	1,022
Stratum 4	25,000 – 50,000	147	502	1,032
Stratum 5	Under 25,000	775	529	1,527
Totals		1,097	4,206	6,820

A Commercial Lighting Programs participant survey was conducted in order to assess participant decision-making and customer satisfaction levels. The survey results indicate a high level of customer satisfaction with the program. Eighty-five percent of the customers responded that they are "very satisfied" with the program, while 13 percent responded that they are "somewhat satisfied." Also, 68 percent of the respondents indicated that they have an improved opinion of BPA as the direct result of this program, while none indicated that the program has worsened their opinion of BPA.

The survey results also indicate that contractor's approach generates 44% of the program enrollment, and that energy costs appear to be the dominant factor in why customer decided to replace their lighting.

1. INTRODUCTION

Under contract with the Bonneville Power Administration (BPA), ADM Associates, Inc. (ADM) has performed an evaluation of BPA's Standard Offer Commercial Lighting Programs. Through this program, commercial customers in the service territories of participating utilities receive rebates for installing energy efficient lighting equipment. The evaluation was intended to provide information to improve and/or refine the program energy savings and demand reduction estimates for the programs, and gauge the level of customer satisfaction with these programs.

1.1. DESCRIPTION OF PROGRAMS

The Standard Offer Commercial Lighting Programs are offered by over 40 public utility companies that participate in BPA's Commercial and Industrial Lighting Rebate Program. The individual programs offered by the utilities typically follow a "roadmap" that is provided by BPA. The programs employ the following procedure.

1. Participating utilities market the program to customers using materials provided by BPA.
2. The utilities conduct a pre-inspection and audit for interested customers. A work plan is created and submitted to BPA for approval. Projects at existing facilities should improve lighting efficiency by 30 percent or more.
3. Each participating customer signs an agreement form, and the installer (typically a lighting contractor) completes the lighting rebate proposal, which is approved by the utility company before installation begins.
4. Installation is completed.
5. The utility verifies the installation with a post-installation inspection.
6. The utility pays the customer and is reimbursed by BPA. The rebates are paid on a per-measure basis and are capped at 70 percent of the total installed cost.

BPA facilitates this process by providing several tools to the utilities and to the independent lighting contractors. These tools include:

- Calculators and Audit Tools: In particular, the 'CILO Calculator' is an Excel-based tool that contains a site audit data entry form that facilitates energy and cost calculations, generates a verification report and a letter requesting a rebate, and also contains look-up tables with wattages, ballast factors, light outputs, for most market-available lighting components. The tool also contains lighting technology application guides and useful tips, definitions, and a list of applicable BPA rebates.
- Marketing flyers;
- Training slides and tip sheets for vendors;
- Energy efficiency educational materials;

- Step-by-step procedures;
- Sample agreements;
- Case studies; and
- Checklists.

1.2. OVERVIEW OF APPROACH

The overall objective for evaluation of the Commercial Lighting Programs was to determine annualized energy savings and coincident/non-coincident demand impacts resulting from participation in the programs.

- ADM collected data for the study through review of program documentation, on-site inspection, metering, and interviews with customers. Based on data provided by BPA, sample designs were developed for on-site data collection for the impact evaluation of the Commercial Lighting Programs with ±10% precision at the 90% confidence level.
- We reviewed the documentation in 199 project files with respect both to the lighting equipment changed and the new equipment installed. We reviewed information about the savings calculation methodologies used for the projects, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations. Based on this review, we determined (1) whether the methodology used for the calculations was appropriate, (2) whether assumptions used were reasonable and appropriate, and (3) whether savings calculations were done correctly.
- We visited 74 facilities to collect data on the lighting equipment replaced. We used lighting loggers to monitor the operation of the affected lighting. The lighting loggers were left at the facility for a minimum of two weeks. Of the 74 sites, data were obtained for 69 sites. (Logger malfunctions at several sites resulted in corrupt data.)
- We administered a survey questionnaire to program participants to learn about their decision-making process, and how the availability of funds from BPA's programs affected their decision to upgrade their lighting to high efficiency lighting. This survey was also designed to gauge the level of satisfaction among the program participants. A total of 40 participants responded to our request for an interview.

1.3. ORGANIZATION OF REPORT

This report on the evaluation of the Commercial Lighting Programs is organized as follows.

- Chapter 2 discusses the sample design and the procedures used to collect the data on which this report is based.
- Chapter 3 presents and discusses the methods used for, and the results obtained from, estimating energy savings for measures installed under the Commercial Lighting Programs.
- Chapter 4 discusses findings of the program participant survey.

- Appendix A provides a copy of the Commercial Lighting Programs participant questionnaire.
- Appendix B provides a copy of the on-site data collection form.

2. DATA COLLECTION METHODOLOGY

The evaluation of BPA's Standard Offer Commercial Lighting Programs was based on an extensive body of data collected in various ways: through review of program documentation, through on-site data collection and monitoring, and through participant surveying. The collection and preparation of the data used for the evaluation are described in this chapter.

2.1 SAMPLING PLAN

The target population for the sampling consisted of commercial and industrial firms that installed energy efficient lighting through the Standard Offer Programs that BPA fielded through participating utilities.

For purposes of sample design and selection, a sampling frame was constructed using information from an Excel file on lighting projects provided by BPA staff. The sampling unit for this survey is a customer lighting project. There were 1,097 lighting projects identified in the file provided by BPA.

Based on discussions with BPA staff, the sample sizes for the survey were set at 225 for the review of files, and 75 for the on-site data collection and monitoring.

With the sampling frame for the survey developed, the next step in preparing the sampling plan was to develop a stratification scheme. As the first step in the stratification analysis, projects were stratified according to the level of expected annual kWh savings. The strata limits are shown in Table 2-1.

Table 2-1. Strata Definitions for Lighting Projects

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Expected kWh Savings in Stratum*	*Percent of Expected Program kWh Savings*
Certainty	Over 400,000 kWh	13	11,699,400	26.7%
Stratum 1	200,000 – 400,000	26	7,577,756	17.3%
Stratum 2	100,000 – 200,000	48	6,458,132	14.8%
Stratum 3	50,000 – 100,000	88	6,260,873	14.3%
Stratum 4	25,000 – 50,000	147	5,255,403	12.0%
Stratum 5	Under 25,000	775	6,516,853	14.9%
Totals		1,097	43,768,417	100.0%

Different allocations across the kWh savings strata for the 225 sample points for the file review were examined and evaluated by considering the precision with which total kWh savings could be estimated. Table 2-2 shows the selected allocation, where the 13 sites with the largest savings

are selected with certainty for file review[1], and the remaining sample points are allocated to non-certainty strata.

Table 2-2. Sample Design for Selecting Projects for File Reviews

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects Selected for File Review*
Certainty	Over 400,000 kWh	13
Stratum 1	200,000 – 400,000	26
Stratum 2	100,000 – 200,000	48
Stratum 3	50,000 – 100,000	47
Stratum 4	25,000 – 50,000	42
Stratum 5	Under 25,000	49
Totals		225

Projects within the non-certainty kWh savings strata (stratum 1-5) were selected for the file review through random sampling. For this sampling, each project was assigned a random number and projects within each stratum were sorted by these random numbers. Projects in a stratum were then selected by working down the sorted list of projects for that stratum until the required number of projects was selected.

The sample allocation for the on-site data collection and monitoring was 75 projects. Because of the costs associated with conducting the monitoring, it was determined to geographically concentrate the monitoring effort. Review of the locations of the lighting projects showed that 545 projects, accounting for over 20.5 million kWh savings (about 47 percent of all savings), were accounted for by six utilities (see Table 2-3).

Table 2-3. Six Utilities with Most kWh Savings from Lighting Projects

Utility	*State*	*Number of Projects*	*Expected kWh Savings*
Flathead Electric Coop., Inc.	MT	261	6,477,703
Central Lincoln PUD	OR	106	3,222,843
Cowlitz County PUD	WA	52	3,057,428
Lewis County PUD	WA	13	2,902,063
Klickitat County PUD	WA	14	2,624,941
Oregon Trail Electric	OR	99	2,270,008
Totals for six utilities		545	20,554,986

[1] These sites are selected with certainty for file review only, and not necessarily for field monitoring.

Based on these data, the four areas represented by these six utilities were chosen as the areas in which to conduct on-site monitoring. Based on the relative proportions of kWh savings for the overall program that were accounted for by utilities in different states, the 75 sample points for the monitoring were allocated to the four areas shown in Table 2-4.

Table 2-4. Allocation of Sample Points for Selection of Monitoring Sites

Area	*Utility*	*State*	*Sample Points*	
			Initial	*Supplement*
Montana	Flathead Electric Coop., Inc.	MT	16	0
Western Oregon	Central Lincoln PUD	OR	16	14
Washington	Cowlitz County PUD Lewis County PUD Klickitat County PUD	WA	28	33
Eastern Oregon	Oregon Trail Electric	OR	15	14
Totals			75	61

The 75 monitoring sites were to be chosen from among the 225 projects selected for file review. The initial sample selection produced 45 projects for file review from Flathead Electric, which allowed for selection of 16 monitoring sites. However, the number of projects initially selected for the other three areas were not large enough to provide back-ups for recruitment if initial sites could not be recruited for the monitoring. Accordingly, additional sample points were chosen for the utilities representing Western Oregon, Eastern Oregon, and Montana. The numbers of supplemental sample points are shown in Table 2-4.

2.2 DATA COLLECTION AND MONITORING PROCEDURES

This section describes the procedures used for the review of project files, for the on-site data collection and monitoring, and for the survey of customers.

2.2.1 Project Files Review

ADM requested 225 project files for the documentation review, of which 199 were provided. For these 199 files, we used the documentation in each project's file to review both the lighting equipment changed and the new equipment installed. We reviewed the information about the savings calculation methodology that was used for the project, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations.

2.2.2 On-Site Data Collection

We collected primary data on the facilities of the customers selected for the study sample through on-site visits. We visited each sample to perform monitoring with time-of-use loggers to obtain data for assessing hours of lighting operation. Of the 75 sites in the sample for on-site

visits, data collection was completed at 74 sites. Monitoring data were obtained for 69 sites. (Problems with loggers resulted in irreparably corrupt data for several sites.) Table 2-6 shows the distributions across sampling strata for number of sites visited and the number of sites for which monitored data were collected.

Table 2-5. Sample Design for On-Site Visits

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Sites Visited*		*Sites with Monitoring Data*	
		Number of Projects in Stratum	*Expected kWh Savings*	*Number of Projects in Stratum*	*Expected kWh Savings*
Certainty	Over 400,000 kWh	2	1,941,112	2	1,941,112
Stratum 1	200,000 – 400,000	3	714,821	3	714,821
Stratum 2	100,000 – 200,000	11	1,452,897	11	1,452,897
Stratum 3	50,000 – 100,000	12	840,509	10	659,222
Stratum 4	25,000 – 50,000	19	608,482	18	582,920
Stratum 5	Under 25,000	27	215,787	25	206,535
Totals		74	5,773,608	69	5,557,507

We conducted the on-site evaluation work through the following steps:

- Identify the potential candidates for onsite data collection;
- Call customers to recruit for evaluation measurements; and
- Make visits to verify equipment installation and lighting levels, to install lighting loggers, and to administer customer satisfaction questionnaire;

Our field staff accomplished several tasks during the on-site visit. First, they verified that the rebated measures were indeed installed. Second, they collected the data needed to analyze the energy savings that had been realized from the installed measures. Third, they administered the program participant survey instrument.

During the visit, the field staff also installed time-of-use loggers to obtain some important items of data needed for the analysis of energy savings (primarily data on the operating hours and peak hours utilization of the lighting equipment). We monitored the hours of operation as the basis for calculating lighting efficiency savings. For this monitoring of lighting operating hours, we used Time-of-Use (TOU) data loggers manufactured by Pacific Science and Technology. The TOU loggers provided a time profile of on-off usage, and therefore allowed the calculation of kWh usage according to peak/off-peak periods. (In practice, the loggers sense when a fixture is on by detecting the light emitted from a fixture when it is operating.)

For each facility with multiple lighting efficiency measures that was selected for monitoring, we developed a plan for monitoring the subset of retrofitted fixtures that are most likely to represent the usage patterns for all retrofitted fixtures in a given site or area. In many cases, the degree of

homogeneity among fixtures within a defined usage area was very high due to the size of the establishment, thus requiring that only a few fixtures be monitored to determine hours of operation. In cases where there were areas with distinctly different operating hours within the same building, we performed monitoring on fixtures located in the different areas, and took an average, weighted by the connected load of the fixtures, of the operating hours based on the quantity of fixtures that were replaced in each area.

Our general procedure for the installation of the loggers was to place lighting loggers within representative lighting fixtures. The logger's serial number, location, fixture type and specifications, and the number of fixtures represented by the fixture monitored were recorded. The representative lighting fixture for an area was chosen on the basis of the fixture type and expected time of use patterns. The type and number of lighting fixtures connected in the circuit was also recorded.

Installation of lighting loggers involved the following steps:

- Open up fixture and record lamp and ballast specifications.
- Adjust lighting level threshold on lighting logger. Using a small flat screwdriver, slowly adjust the logger so that it turns on at just that lighting level, when it is held 18 inches from the fixture lamps. Press the reset button on the logger.
- Place lighting logger in fixture. While loggers can be placed in many fixtures using the magnetic strip on the logger, double-sided tape may be needed to hold the logger in a non-ferrous fixture. Care was taken when installing loggers into reflective fixtures, so as not to diminish the reflective qualities. Many fixtures have lens covers that need to be opened up to place the loggers; for such fixtures, the loggers were placed so that the light sensor was pointed at the lamp.
- Record the serial number of the logger, the date and time of installation, and the site and location in the building. Draw a sketch of the facility and identify the fixture location clearly enough so someone else can find it.
- Place a colored sticker on the outside of the fixture so it can be identified as someone walks up to it.

Each logger was left on-site to collect data for an average of two weeks of operation. These data were extracted from the loggers at the end of the monitoring period through one last on-site visit.

After the on-site data were entered into our internal database, they went through several stages of error-checking to detect errors that might have been introduced through the data entry process, to detect errors and/or inconsistencies that may exist within the data for a given facility, and to detect any internal inconsistencies within the database. This in-house data reduction and error checking effort ensured that the data collected are of high quality, internally consistent and are sufficiently complete to allow analysis of end-use energy use and savings for the facilities.

2.2.3 Survey Procedures

The information needed to assess participant decision-making and customer satisfaction levels was collected by administering a survey questionnaire. All participants selected for on-site visits were requested to complete the survey during the site visit. Customers completed the questionnaire for 40 of the 74 sites where visits were performed (or 54 percent of the sample size).Of the 34 sites that failed to complete the questionnaire, the primary reason for non-participation was that the owner or manager that was involved in the rebate process was unavailable during the site visits. In such cases, the field engineer provided a copy of the survey along with a stamped, addressed envelope. The response rates for such mail-in surveys are typically much lower than those for on-site interviews.

In the interviews, data were collected pertaining to customers' decision-making criteria, their attitudes, and their behavior. Essentially, the customers were questioned regarding their knowledge of BPA's programs, their level of interest in the programs, their reasons for participating, and the measure implementation decisions they would have made had they not participated in the Commercial Lighting Programs.

A copy of the participant survey questionnaire is provided in Appendix A. The questionnaire was designed to gather the following types of information:

- How energy decisions were made
- How much influence the Commercial Lighting Programs had upon energy decisions
- Whether or not measures would have been installed in the absence of the program.

3. ESTIMATES OF ENERGY SAVINGS

This chapter provides estimates of energy savings for lighting projects.

3.1 ANALYSIS PROCEDURES

We used data collected from on-site visits and through monitoring in analyses to estimate the energy savings available from the various installed energy conservation measures. To analyze savings for lighting measures, we used our Lighting Evaluation Model. Analyzing the savings from lighting measures with this model required data for retrofitted fixtures on (1) wattages before and after retrofit; (2) hours of operation and (3) number of fixtures replaced.

We collected time-of-use data with which to determine average operating hours for retrofitted fixtures by using time-of-use (TOU) data loggers, to monitor the subset of retrofitted fixtures that are most likely to represent the usage patterns for all retrofitted fixtures in usage areas where lighting efficiency measures had been installed. Usage areas are defined to be those areas within a facility that are expected to have comparable average operating hours.

We used per-fixture baseline demand, retrofit demand, and appropriate post-retrofit operating hours to calculate peak capacity savings and annual energy savings for sampled fixtures of each usage type. The on-off profile and the fixture wattages were used to calculate post-retrofit kWh usage. We calculated annual energy savings for each sampled fixture per the following formula:

$$\text{Annual Energy Savings} = \text{kWh}_{\text{Before}} - \text{kWh}_{\text{After}}$$

We calculated demand for a fixture by averaging the hourly demand of the lighting system during the peak, using the data collected through the on-site time-of-use monitoring. Summer peak demand is defined as demand between 6 and 9 PM weekdays. Winter peak demand is defined as demand between 7 and 10 AM weekdays. We calculated Peak Period Demand Savings as the difference between peak period baseline demand and post-installation peak period demand of the affected lighting equipment, per the following formula:

$$\text{Peak Capacity Savings} = \text{kW}_{\text{Before}} - \text{kW}_{\text{After}}$$

The values for insertion in these formulas were determined through the following steps:

- We used the number of fixtures for which replacement had been verified, along with their associated wattages based on the type of fixture, to calculate the peak capacity before and after the lighting replacement.
- We used results from the monitored sample to calculate the average usage rate of the lighting system during the summer and winter peak demand periods. We applied this average to the peak demand values before and after replacement. The peak capacity savings is the sum of the difference between baseline and post-installation average peak demand for all of the usage areas.

- We also used results from the monitored sample to calculate the average annual operating hours of the metered lights for every unique building type/usage area. We then applied these average operating hours to the baseline and post-installation for each usage area, to calculate the respective energy consumption for each usage area.
- The annual baseline energy usage is the sum of the baseline kWh for each year for all of the usage areas. The post-retrofit energy usage was calculated similarly. The energy savings were calculated as the difference between baseline and post-installation energy usage.

Program-level energy savings for the Commercial Lighting Programs were developed by applying achieved savings realization rates calculated for each stratum of the analysis sample to each stratum of the program-level data for BPA reported savings. Realization rates were used to describe the relationship between program expected savings estimates and calculated savings. The realization rate for each stratum was calculated as the ratio of our calculated measure savings to the BPA reported savings. (Reported savings had been developed by BPA as part of the program application and recorded in the program tracking database.)

The ratio estimate of program-level savings is calculated using the following formula:

$$\hat{Y}_R = \frac{y}{x}X = \frac{X}{x}y$$

where Y_R is the estimate for program-level gross savings, y is the sample total for gross savings, x is the sample total for the auxiliary variable (the claimed kWh savings as recorded in the rebate forms), and X is the population total for the auxiliary variable. For this ratio estimation of program-level savings, estimates of the expected savings from the program tracking records were used as the auxiliary information.

3.2 RESULTS OF PROJECT FILE REVIEW

Based on the review of 199 project files, we determined that, with very few exceptions, the methodology used for the calculation was appropriate, that the assumptions made were reasonable and appropriate, and that savings calculations were performed correctly. We also verified that the operating hours reported for a particular project were within the usual range of operating hours for that type of commercial facility.

Of the 199 project files reviewed, 174 (87 percent) did not require any adjustment. The remaining 25 projects required adjustments of claimed energy savings. Of these 25, seven had their energy savings revised up by at least 10%, and ten projects had their energy savings revised down by at least 10 percent.

- The most common reason to revise savings upwards was that, in several instances, the energy savings for a subset of the measures were inadvertently entered with negative values.
- The most common reason to revise savings downwards was that a reduction of operating hours was claimed by the customer, but there was no record of a control measure that would

effect such a reduction of hours (e.g. occupancy sensors). In these cases the components of the savings that were due solely to reductions in operating hours were removed.

Apart from corrections for such errors, there were very few other adjustments warranted by the file review. In a few instances, the operating hours were judged to be inconsistent with both the hours reported for other fixtures in similar areas within a building and with typical operation hours for the given market sector. If there was compelling evidence that the operation hours were mistakenly recorded, they were revised to the most probable value.

Some of the manufacturing facilities and mills reported 8,760 hours of operation per year. We did not officially revise these numbers down, but it is unlikely that any such operation is truly '8,760 hours per year'[1]. However, as noted in the footnote, at least one site was monitored to have all monitored lights on for the entire five-week monitoring period. Table 3-1 summarizes the results of the file review process. The projects that report the largest amounts of savings are typically revised downward, while the smaller projects tend to be revised slightly upward.

Table 3-1. Claimed and Adjusted Savings for Sites Undergoing File Review

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Sites*	*Total kWh Savings Reported on Form*	*Post File Review Adjusted kWh Savings*	*Ratio of Adjusted to Original Claimed Savings*
Certainty	Over 400,000 kWh	9	7,428,340	7,078,349	0.95
Stratum 1	200,000 – 400,000	16	4,246,855	4,200,870	0.99
Stratum 2	100,000 – 200,000	32	3,615,353	3,466,438	0.96
Stratum 3	50,000 – 100,000	34	2,165,511	2,143,273	0.99
Stratum 4	25,000 – 50,000	53	1,803,693	1,827,567	1.01
Stratum 5	Under 25,000	55	446,283	455,416	1.02
Totals		199	19,706,035	19,171,913	0.97

Upon completing our review of the project files, we re-visited our sampling plan for the monitoring effort. We leveraged the project file review in order to select sites for monitoring that are most representative–not just according to reported kWh, but also according to reported hours of use, etc. For example, sites with small kWh savings were selected that were expected to be very similar to many other sites in population of program projects.

[1] One such site was later monitored, and it did have the lights on for the entire five-week monitoring period. However, the monitoring period did not contain any major holidays.

3.3 VERIFIED OPERATING HOURS

Table 3-2 presents the expected and verified average operating hours for the replaced fixtures at the sampled sites. The expected hours of operation are those presented in the project files. The operating parameters presented in Table 3-2 were obtained through time-of-use monitoring consistent with the procedure outlined previously. On average, the verified operating hours for facilities with relatively low expected energy savings are longer than expected, while the verified operating hours for facilities with the highest expected energy savings are shorter than expected.

Table 3-2. Verified Operating Hours for Sampled Sites

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Expected Hours of Operation*	*Verified Hours of Operation*
Certainty	Over 400,000 kWh	2	8,704	7,256
Stratum 1	200,000 – 400,000	3	6,522	5,800
Stratum 2	100,000 – 200,000	11	4,128	4,321
Stratum 3	50,000 – 100,000	10	3,872	3,610
Stratum 4	25,000 – 50,000	18	3,371	3,717
Stratum 5	Under 25,000	25	2,935	3,670
Totals		69	5,061	4,818

Table 3-3 projects the expected and verified operating hours for the sampled sites by business type.

Table 3-3. Estimated Operating Hours for Sample Sites by Business Type

Type	Count of Type	Expected Hours of Operation	Verified Hours of Operation
Auto Repair	7	3,334	4,045
Manufacturing	16	5,327	5,301
Medical	8	6,803	6,830
Office	10	2,990	2,939
Other	6	4,600	4,774
Retail	10	4,014	4,177
School	9	3,081	2,761
Worship	3	2,210	2,279
Grand Total	69	4,275	4,337

Table 3-4 projects the expected and verified operating hours for each stratum of the sampled sites to the overall program data. For the 1,097 program projects, a lower number of average operating hours is estimated than for the 69 sampled sites, because sites with lower expected

energy savings, on average, had fewer operating hours, and were sampled with lower frequency than sites with high expected energy savings.

Table 3-4 Estimated Operating Hours for Program Sites

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Expected Hours of Operation*	*Verified Hours of Operation*
Certainty	Over 400,000 kWh	13	8,704	7,256
Stratum 1	200,000 – 400,000	26	6,522	5,800
Stratum 2	100,000 – 200,000	48	4,128	4,321
Stratum 3	50,000 – 100,000	88	3,872	3,610
Stratum 4	25,000 – 50,000	147	3,371	3,717
Stratum 5	Under 25,000	775	2,935	3,670
Totals		1,097	4,623	4,546

3.4 ESTIMATES OF PROGRAM ENERGY SAVINGS

The estimates of program-level annual energy savings are presented in this section. The expected and verified savings and the realization rates for the 69 sampled sites are presented by stratum in Table 3-5. Table 3-6 presents these energy savings and realization rates by utility, while Table 3-7 presents them by business type. The 16 manufacturing sites in the sample have a realization rate of 88 percent, while the ten office sites have a realization rate of 118 percent.

Table 3-5. Estimated Energy Savings and Realization Rates by Stratum for Sampled Sites

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Sampled Projects in Stratum*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate*
Certainty	Over 400,000 kWh	2	1,941,112	1,618,171	83.4%
Stratum 1	200,000 – 400,000	3	714,821	635,662	88.9%
Stratum 2	100,000 – 200,000	11	1,452,897	1,520,749	104.7%
Stratum 3	50,000 – 100,000	10	659,222	614,624	93.2%
Stratum 4	25,000 – 50,000	18	582,920	642,744	110.3%
Stratum 5	Under 25,000	25	206,535	258,240	125.0%
Totals		69	5,557,507	5,290,190	95.2%

Table 3-6. Estimated Energy Savings and Realization Rates by Utility for Sampled Sites

Utility	*Number of Sampled Projects*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate*
Flathead Electric Coop., Inc.	20	1,309,160	1,309,468	100.0%
Cowlitz County PUD	18	1,095,007	1,099,289	100.4%
Central Lincoln PUD	12	285,126	335,106	117.5%
Oregon Trail Electric	12	501,482	556,030	110.9%
Klickitat County PUD	5	549,537	539,166	98.1%
Lewis County PUD	2	1,817,195	1,451,130	79.9%
Totals	69	5,557,507	5,290,190	95.2%

Table 3-7. Estimated Energy Savings and Realization Rates by Business Type for Sampled Sites

Business Type	*Number of Sampled Projects*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate*
Manufacturing	16	3,325,345	2,920,629	87.80%
Office	10	181,305	214,276	118.20%
Retail	10	294,629	292,674	99.30%
School	9	721,717	692,765	96.00%
Medical	8	393,109	424,352	107.90%
Auto Repair	7	207,794	255,226	122.80%
Other	6	339,992	403,446	118.70%
Worship	3	93,617	86,822	92.70%
Totals	69	5,557,507	5,290,190	95.2%

Table 3-8 presents expected and verified savings annual energy savings for the 69 sampled sites by expected duration of annual operating hours. Longer expected operating hours are associated with lower energy savings realization rates. Sites expected to operate fewer than 3,000 hours annually have a realization rate of 116 percent, while sites expected to operate at least 6,000 hours annually have a realization rate of 81 percent.

Table 3-8. Estimated Energy Savings and Realization Rates by Expected Annual Operating Hours for Sampled Sites

Expected Annual Operating Hours	*Number of Sampled Projects*	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rate*
<3000	22	848,864	980,366	115.5%
3000 - 6000	35	1,887,988	2,022,638	107.1%
6000 - 8760	12	2,820,656	2,287,186	81.1%
Totals	69	5,557,507	5,290,190	95.2%

Estimated overall program energy savings and realization rates were developed by applying the stratum-specific realization rates for the sampled facilities to the overall program data reported in the tracking system. The estimated program-level savings are summarized in Table 3-9. The program achieved over 43 GWh per year of verified savings through nearly 1,100 individual projects during the 2004-2006 cycles. These are first-year savings assuming a measure life of at least one year.

Table 3-9. Estimated Program Energy Savings

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Expected kWh Savings*	*Stratum-Specific Realization Rate*	*Verified kWh Savings*
Certainty	Over 400,000 kWh	13	11,699,400	83.4%	9,752,980
Stratum 1	200,000 – 400,000	26	7,577,756	88.9%	6,738,593
Stratum 2	100,000 – 200,000	48	6,458,132	104.7%	6,759,735
Stratum 3	50,000 – 100,000	88	6,260,873	93.2%	5,837,303
Stratum 4	25,000 – 50,000	147	5,255,403	110.3%	5,794,758
Stratum 5	Under 25,000	775	6,516,853	125.0%	8,148,332
Totals		1,097	43,768,417	98.3%	43,031,701

Tables 3-10 presents annual energy savings during the summer and winter peak demand hours at the 69 sampled sites, while Table 3-11 presents this information for 1,097 program projects. Summer peak demand is defined as demand between 6 and 9 PM weekdays. Winter peak demand is defined as demand between 7 and 10 AM weekdays.

Hourly monitoring data were used to verify energy savings during the summer and winter peak demand hours for the sampled sites. Estimated peak period savings for the sampled sites were extrapolated to the overall program data by applying stratum-specific ratios of verified total savings for all program sites to the verified total savings for the sampled sites.

Table 3-10. Estimated Summer and Winter Peak Energy Savings for Sampled Sites

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Verified Summer Peak kWh Savings*	*Verified Winter Peak kWh Savings*
Certainty	Over 400,000 kWh	2	139,640	155,211
Stratum 1	200,000 – 400,000	3	67,152	74,372
Stratum 2	100,000 – 200,000	11	142,918	216,549
Stratum 3	50,000 – 100,000	10	44,710	92,623
Stratum 4	25,000 – 50,000	18	48,100	98,452
Stratum 5	Under 25,000	25	12,706	41,801
Totals		69	455,226	679,008

Table 3-11. Estimated Summer and Winter Peak Program Energy Savings

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Verified Summer Peak kWh Savings*	*Verified Winter Peak kWh Savings*
Certainty	Over 400,000 kWh	13	842,854	936,836
Stratum 1	200,000 – 400,000	26	712,904	789,557
Stratum 2	100,000 – 200,000	48	636,193	963,954
Stratum 3	50,000 – 100,000	88	425,243	880,945
Stratum 4	25,000 – 50,000	147	434,279	888,899
Stratum 5	Under 25,000	775	401,494	1,320,876
Totals		1,097	3,452,968	5,781,067

3.5 PROGRAM DEMAND IMPACTS

Table 3-12 summarizes program impacts on summer and winter peak demand at the 69 sampled sites. Summer peak demand is defined as demand between 6 and 9 PM weekdays. Winter peak demand is defined as demand between 7 and 10 AM weekdays.

Table 3-12. Summary of Summer and Winter Peak Demand Reductions by Stratum for Sampled Sites

Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Verified Summer Peak Demand Reduction (kW)*	*Verified Winter Peak Demand Reduction (kW)*
Certainty	Over 400,000 kWh	2	186	207
Stratum 1	200,000 – 400,000	3	90	99
Stratum 2	100,000 – 200,000	11	191	289
Stratum 3	50,000 – 100,000	10	60	123
Stratum 4	25,000 – 50,000	18	64	131
Stratum 5	Under 25,000	25	17	56
Totals		69	607	905

Table 3-13 presents program impacts on summer and winter peak demand for the 1,097 sites in the sampling frame.

Table 3-13. Summary of Summer and Winter Peak Program Demand Reductions by Stratum

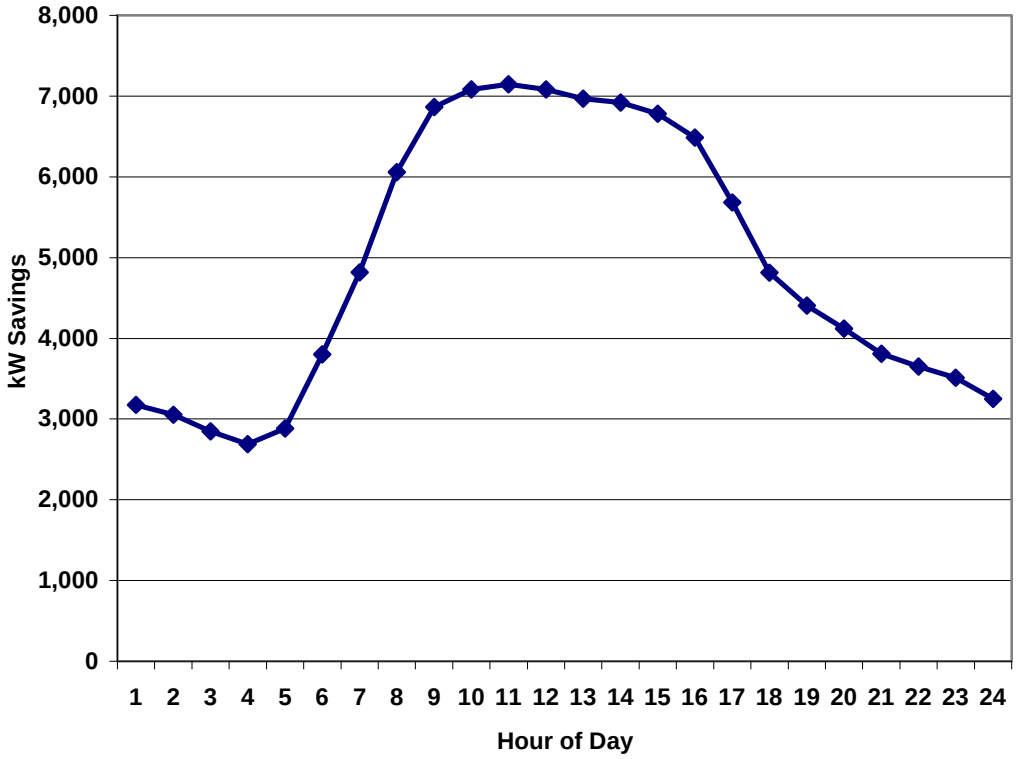
Stratum	*Stratum Cut Offs (kWh Savings per Year)*	*Number of Projects in Stratum*	*Verified Summer Peak Demand Reduction (kW)*	*Verified Winter Peak Demand Reduction (kW)*
Certainty	Over 400,000 kWh	13	1,124	1,249
Stratum 1	200,000 – 400,000	26	951	1,053
Stratum 2	100,000 – 200,000	48	848	1,285
Stratum 3	50,000 – 100,000	88	567	1,175
Stratum 4	25,000 – 50,000	147	579	1,185
Stratum 5	Under 25,000	775	535	1,761
Totals		1,097	4,604	7,708

An hourly profile of program kW demand savings is presented in Table 3-14. The data are then presented graphically in Figure 3-1.

Table 3-14. Program kW Demand Reduction

Hour of Day	*kW Demand Reduction*	*Hour of Day*	*kW Demand Reduction*
1	3,175	13	6,967
2	3,052	14	6,920
3	2,848	15	6,784
4	2,690	16	6,486
5	2,882	17	5,684
6	3,798	18	4,813
7	4,816	19	4,406
8	6,059	20	4,120
9	6,863	21	3,809
10	7,081	22	3,648
11	7,144	23	3,513
12	7,083	24	3,251

Figure 3-1. Program kW Demand Reduction Profile



4. PROGRAM PARTICIPANT SURVEY FINDINGS

This chapter provides data and discussion regarding findings of the Commercial Lighting Programs participant survey. The information needed to assess participant decision-making and customer satisfaction levels was collected through a survey. All participants selected for onsite visits were requested to complete the survey during the site visit. The questionnaire was completed for 40 of the 74 sites where visits were performed (or 54 percent of the sample size). .Of the 34 sites that failed to complete the questionnaire, the primary reason for non-participation was that the owner or manager that was involved in the rebate process was unavailable during the site visits. In such cases, the field engineer provided a copy of the survey along with a stamped, addressed envelope. The response rates for such mail-in surveys are typically much lower than those for on-site interviews. .

In the interviews, data were collected that pertained to customers' decision-making criteria, and their attitudes and behavior. Essentially, the customers were questioned regarding their knowledge of BPA's programs, their level of interest in the programs, their reasons for participating, and the measure implementation decisions they would have made had they not participated in the Commercial Lighting Programs.

A copy of the program participant survey questionnaire is provided in Appendix A. The questionnaire was designed to gather the following types of information:

- How energy decisions were made
- How much influence the Commercial Lighting Programs had upon energy decisions
- Whether or not measures would have been installed in the absence of the program

Tabulations of the survey responses are presented in this chapter. There are two sets of tables.

- The first set of tables pertain to customers' general decision making about purchasing and installing energy efficient equipment.
- The second set of tables pertain to customers' experience with the Commercial Lighting Programs.

The responses to the site visit survey provide some guidance as to possible changes in the design and/or implementation of the Commercial Lighting Programs. Moreover, the responses provide some indication of what customers like and dislike about the programs.

- Contractor's approach makes up 44 percent of the program enrollment. This underlines the role of the contractor as the initiator of the programs. The higher number of the contractors that participate in the program, the better the likelihood that more customers will be enrolled in this program.

- Energy costs appear to be the dominant factor in why the customers decided to replace their lighting. 87 percent of the respondents answered that this was their primary motivation in replacing the lights.

Overall, customers appeared very satisfied with the programs.

- 85 percent of the customers responded that they are "very satisfied" with the program, while 13% responded that they are "somewhat satisfied."
- Over 80 percent of the respondents rated the service they received from the contractors as either "excellent" or "good" in several categories. Most of the dissatisfaction lies with the timing of work completion.
- 68 percent of the respondents appeared to have an improved opinion of BPA as the direct result of this program, and not a single respondent answered that the program has caused a worse opinion of BPA.

Customers' satisfaction with the program was also evident in the comments that they made during the interviews. However, some customers did note problems One customer, who needed to clean up after the contractor, was dissatisfied.

- One customer commented that there was poor communication on the part of the contractor.
- One customer reported that the newly installed lights burned out en masse three times over a two-year period. In the first instance, the contractor replaced the lights free of charge. The customer suspects a ballast/lamp mismatch but cannot prove it.
- The same customer above complained of mercury levels in the fluorescent lamps that are rebated by the program.

No significant patterns or correlations were apparent among the above complaints (e.g., the same utility, contractor, or the same model/make light fixtures were involved). As such, the relatively few complaints were most likely isolated incidents, and did not indicate a systematic flaw in the rebate process.

4.1 CUSTOMERS' AWARENESS AND DECISION MAKING PROCESS

The following tabulations show how customers responded to questions regarding their awareness of the Commercial Lighting Programs and their decision making processes.

How did you first hear about the Commercial Lighting Program?	*Response*	*(n=39)*
	Was contacted by a contractor	44%
	Other	33%
	Utility bill message	8%
	Don't know	8%
	Received information in mail	5%
	Utility web site	3%
	Read newspaper or magazine article	0%

How easy was it for you to understand the requirements for participating in the Commercial Lighting Program?	*Response*	*(n=40)*
	Very easy	40%
	Somewhat easy	43%
	Somewhat difficult	10%
	Very difficult	0%
	Don't know	8%

Did you have a contractor assist you in the lighting project?	*Response*	*(n=40)*
	Yes	83%
	No	15%
	Don't know	3%

How helpful was the contractor's staff in answering questions about energy efficient lighting equipment and providing professional support?	*Response*	*(n=38)*
	Very helpful	66%
	Somewhat helpful	16%
	Not very helpful	3%
	Not at all helpful	0%
	There was no contractor involved	13%
	Don't know	3%

Did the contractor tell you that your utility company was providing a rebate that the contractor was applying to reduce the cost of installing the energy efficient lighting equipment?	*Response*	*(n=33)*
	Yes	88%
	No, do not remember	9%
	No, did not tell me	0%
	Don't know	3%

	Response	*(n=33)*
Did the contractor recommend or select the new equipment?	Yes	85%
	No	15%

	Response	*(n=26)*
If the contractor had not recommended installing new lighting system, how likely is it that you would have installed the same system anyway?	Definitely would have installed	4%
	Probably would have installed	23%
	Probably would not have installed	35%
	Definitely would not have installed	8%
	Don't know	31%

	Response	*(n=34)*
How important was advice and/or recommendations from the lighting contractor in your decision making on energy efficient lighting improvements?	Very important	68%
	Somewhat important	15%
	Only slightly important	9%
	Not important at all	0%
	Don't know	9%

	Response	*(n=39)*
How influential was the utility company's rebate or incentive in your decision to have the energy efficient lighting equipment installed?	Very influential	85%
	Somewhat influential	10%
	Not very influential	0%
	Not at all influential	3%
	Don't know	3%

	Response	*(n=39)*
Why did you choose to have the energy efficient lighting equipment installed?	Wanted to save money on energy costs	87%
	Wanted to be environmentally friendly/ conscious	8%
	Saved money on the cost of new equipment	5%
	Other	0%
	Don't know	0%

	Response	*(n=38)*
Before participating in the Commercial Lighting Program, had you installed any energy efficient lighting equipment or measures at your facility?	Yes	32%
	No	68%

	Response	*(n=39)*
If the utility company's financial incentive had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?	Definitely would have installed	5%
	Probably would have installed	28%
	Probably would not have installed	44%
	Definitely would not have installed	13%
	Don't know	10%

	Response	*(n=39)*
How did the availability of information and financial incentives through the Commercial Lighting Program affect the quantity (number of units) of lighting equipment that you purchased and installed?	Purchased and installed more equipment/measures than otherwise would have	54%
	Did not affect quantity purchased and installed	46%

4.2 CUSTOMERS' SATISFACTION WITH COMMERCIAL LIGHTING PROGRAM

The following tabulations pertain to customers' satisfaction with the Commercial Lighting Programs.

	Response	*(n=36)*
How well would you say the service you received from the lighting contractor for the Commercial Lighting Program met your expectations?	It met all your expectations	83%
	It met some of your expectations	17%
	It did not meet your expectations at all	0%

Overall, how would you rate your satisfaction with the service provided to you: very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied?	*Response*	*(n=39)*
	Very Satisfied	85%
	Somewhat Satisfied	13%
	Somewhat Dissatisfied	3%
	Very Dissatisfied	0%

How would you rate the service on information you received from contractor explaining energy efficient lighting equipment?	*Response*	*(n=35)*
	Excellent	40%
	Good	37%
	Fair	9%
	Poor	0%
	Not Applicable	14%

How would you rate the service on contractor's expertise and experience?	*Response*	*(n=35)*
	Excellent	49%
	Good	37%
	Fair	0%
	Poor	0%
	Not Applicable	14%

How would you rate the service on cost of installing the equipment?	*Response*	*(n=35)*
	Excellent	34%
	Good	49%
	Fair	6%
	Poor	3%
	Not Applicable	9%

How would you rate the service on quality of the contractor's work in installing the energy efficient lighting equipment?	*Response*	*(n=35)*
	Excellent	46%
	Good	40%
	Fair	3%
	Poor	0%
	Not Applicable	11%

	Response	*(n=35)*
How would you rate the service on completion of the work as promised?	Excellent	49%
	Good	37%
	Fair	0%
	Poor	3%
	Not Applicable	11%

	Response	*(n=34)*
Has your experience with the Commercial Lighting Program affected your opinion of (utility), and if so, how?	Yes, improved opinion	68%
	Yes, worsened opinion	0%
	No, has not affected opinion	32%

APPENDIX A
PROGRAM PARTICIPANT SURVEY QUESTIONNAIRE

EVALUATION OF COMMERCIAL LIGHTING PROGRAM PARTICIPANTS SURVEY QUESTIONNAIRE

Customer Name: _____

Date: _____

.....

Please answer the questions for the following facility:

Name of facility: _____

Address: _____

Telephone No.: _____

Customer Name: _____

Title: _____

TO BEGIN, I HAVE SOME QUESTIONS ABOUT YOUR PARTICIPATION IN THE COMMERCIAL LIGHTING PROGRAM

AWARENESS AND DECISION MAKING QUESTIONS:

1. How did you first hear about the Commercial Lighting Program?

- ❑ Received information in mail
- ❑ Read newspaper or magazine article
- ❑ Was contacted by a contractor
- ❑ Utility bill message
- ❑ Utility web site
- ❑ Other *(Specify)* _____
- ❑ Don't know

2. How easy was it for you to understand the requirements for participating in the Commercial Lighting Program?

- ❑ Very easy
- ❑ Somewhat easy
- ❑ Somewhat difficult
- ❑ Very difficult
- ❑ Don't know

3. Did you have a contractor assist you in the lighting project?

- ❑ Yes
- ❑ No
- ❑ Don't know

IF YOU HAD A CONTRACTOR PERFORM THE LIGHTING UPGRADE, PLEASE ANSWER QUESTIONS 4-7

4. How helpful was the contractor's staff in answering questions about energy efficient lighting equipment and providing professional support?

- ❑Very helpful
- ❑Somewhat helpful
- ❑Not very helpful
- ❑Not at all helpful
- ❑There was no contractor involved
- ❑Don't know

5. Did the contractor tell you that your utility company was providing a rebate that the contractor was applying to reduce the cost of installing the energy efficient lighting equipment?

- ❑ Yes, did tell me.

  Did the contractor tell you how much that rebate was?
  - ❑ Yes. Said rebate was **$ _____**
  - ❑ No. Do not remember
- ❑ No, did not tell me.
- ❑ Don't know

6. Did the contractor recommend or select the new equipment?

- ❑ No
- ❑ Yes

If Yes: If the contractor had not recommended installing new lighting system, how likely is it that you would have installed the same system anyway?

- ❑ Definitely would have installed
- ❑ Probably would have installed
- ❑ Probably would not have installed
- ❑ Definitely would not have installed
- ❑ Don't know

7. How important was advice and/or recommendations from the lighting contractor in your decision making on energy efficient lighting improvements?

- ❑ Very important
- ❑ Somewhat important
- ❑ Only slightly important
- ❑ Not important at all

QUESTIONS 8-12 ARE REGARDING THE REBATE PROGRAM'S ROLE IN YOUR DECISION MAKING PROCESS TOWARD LIGHTING UPGRADES

8. How influential was the utility company's rebate or incentive in your decision to have the energy efficient lighting equipment installed?

- ❑ Very influential
- ❑ Somewhat influential
- ❑ Not very influential
- ❑ Not at all influential
- ❑ Don't know

9. Why did you choose to have the energy efficient lighting equipment installed?

- ❑ Wanted to save money on energy costs
- ❑ Wanted to be environmentally friendly/conscious
- ❑ Saved money on the cost of new equipment
- ❑ Other (*Specify*) _____
- ❑ Don't know

10. Before participating in the Commercial Lighting Program, had you installed any energy efficient lighting equipment or measures at your facility?

- ❑ Yes
- ❑ No

11. If the utility company's financial incentive had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?

- ❑ Definitely would have installed
- ❑ Probably would have installed
- ❑ Probably would not have installed
- ❑ Definitely would not have installed
- ❑ Don't know

12. How did the availability of information and financial incentives through the Commercial Lighting Program affect the quantity (number of units) of lighting equipment that you purchased and installed?

- ❑ Purchased and installed more equipment/measures than otherwise would have
  How much more? _____
- ❑ Did not affect quantity purchased and installed

FINALLY, WE HAVE A FEW QUESTIONS ABOUT YOUR EXPERIENCE AND SATISFACTION WITH THE COMMERCIAL LIGHTING PROGRAM.

13. How well would you say the service you received from the lighting contractor for the Commercial Lighting Program met your expectations?
Would you say that:

- ❑ It met all your expectations.
- ❑ It met some of your expectations.
- ❑ It did not meet your expectations at all.

What had you expected from the service that you did not receive?

_____
_____

14. Please think about your <u>overall</u> experience with the service you received in having the energy efficient lighting equipment installed. Consider all aspects of your experience with that service.
<u>Overall</u>, how would you rate your satisfaction with the service provided to you. Would you say you were very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied?

Very Satisfied	*Somewhat Satisfied*	*Somewhat Dissatisfied*	*Very Dissatisfied*	*Would not answer*
❑	❑	❑	❑	❑

Ask only if person answers that he/she was somewhat dissatisfied or very dissatisfied:

Why were you dissatisfied with the service?

_____
_____
_____

15. We now want to ask you more specifically about different features of the service you received in having the energy efficient lighting equipment installed.
Using the scale: Excellent, Good, Fair or Poor
How would you rate the service on the following features:

Was the	***Excellent***	***Good***	***Fair***	***Poor***	***Not Applicable***
Information you received from contractor explaining energy efficient lighting equipment	❑	❑	❑	❑	❑
Contractor's expertise and experience	❑	❑	❑	❑	❑
Cost of installing the equipment	❑	❑	❑	❑	❑
Quality of the contractor's work in installing the energy efficient lighting equipment	❑	❑	❑	❑	❑

Completion of the work as promised	❑	❑	❑	❑	❑

16. Has your experience with the Commercial Lighting Program affected your opinion of UTILITY, and if so, how?

- ❑ Yes. Improved opinion
- ❑ Yes. Worsened opinion
- ❑ No. Has not affected opinion.

17. Do you have any suggestions for changes that could improve the services offered by lighting contractors in the Commercial Lighting Program?

_____

_____

_____

18. That concludes my questions. Do you have any other comments for BPA or the utility company about the Commercial Lighting Program in particular or about energy efficiency in commercial and industrial facilities in general?

_____

_____

_____

Sasha Baroiant, the project manager for this study, can be contacted for further questions. He can be reached at ADM Associates, INC: (916) 363-8383.

Thanks for your help!

Bonneville Power Administration will use your ideas to improve its programs for commercial and industrial customers.

APPENDIX B
ON-SITE DATA COLLECTION FORM

BPA Commercial Lighting Evaluation Study

On-Site Data Collection Form

Survey Date: _____ (month/day/year) __ __ /__ __ /__ __

Surveyor: _____ __

ID Number

Tracking Information:

	Date	***Initials***
Survey Completed:		
Survey Received from Surveyor:		
Quality Control Check Completed:		
Data Entry Completed:		

Introductory Information

Business Name: _

Street Address: _

City, State: _ , _ _ _

Zip Code: _ _ _ _ _ - _ _ _ _

Business Contact:_____

Name: _

Title: _

Phone # ( ): (_ _ _) _ _ _ _ _ _ _ _ _ _ ext. _ _ _ _

Establishment site activity: _____
Activity/Product Description _____
_____
_____

Gross floor area of building (sf)
Number of floors for building
Gross floor area of area affected by lighting project (sf)
Activity in area affected by lighting project

Establishment Site Activity

Office:	Administration and management	011	Restaurant:	Fast Food or Self Service	021
	Financial / Legal	012		Table Service	022
	Insurance/Real Estate	013		Bar/Tavern/Nightclub/Other	023
	Other Office	014			
Food Store:	Supermarket/ Commissary	031	Retail Store:	Department / Variety Store	041
	Convenience Store	032		Shop in Enclosed Mall	042
	Other Food Store	033		Other Retail Store	043
Warehouse:	Refrigerated Warehouse	051	Health Care:	Hospital	061
	Nonrefrigerated Warehouse	052		Nursing Home	062
				Medical Office	063
				Clinic/Outpatient Care	064
Education:	Daycare or Preschool	071	Lodging:	Hotel	081
	Elementary / Secondary School	072		Motel	082
	College or University	073		Barracks	083
	Vocational or Trade School	074			
Public Assembly:	Church	091	Services:	Gas Station / Auto Repair	101
	Recreational or Other	092		Repair (Non-Auto)	102
				Other Service Shop	103
Manufacturing:	Assembly / Light Mfg.	111			
	Med/Heavy Equip. Mfg.	112	Other:	Describe	120
	Food/Beverage Processor	113		Construction	121
	Mining	114		Agriculture	122
	Hanger	115		Outdoor Equipment	123

Operations and Occupancy Schedules Page __ of __

Operating Hours

ID	Sch__	Sch__	Sch__	Sch__
Days	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
Hour	1=open 0=closed	1=open 0=closed	1=open 0=closed	1=open 0=closed
Midnight-1 AM				
1-2 AM				
2-3 AM				
3-4 AM				
4-5 AM				
5-6 AM				
6-7 AM				
7-8 AM				
8-9 AM				
9-10 AM				
10-11 AM				
11 AM-NOON				
NOON-1 PM				
1-2 PM				
2-3 PM				
3-4 PM				
4-5 PM				
5-6 PM				
6-7 PM				
7-8 PM				
8-9 PM				
9-10 PM				
10-11 PM				
11 PM-Midnight				

Occupancy

ID	Sch__	Sch__	Sch__	Sch__
Days	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
Hour	% of Max	% of Max	% of Max	% of Max
Midnight-1 AM				
1-2 AM				
2-3 AM				
3-4 AM				
4-5 AM				
5-6 AM				
6-7 AM				
7-8 AM				
8-9 AM				
9-10 AM				
10-11 AM				
11 AM-NOON				
NOON-1 PM				
1-2 PM				
2-3 PM				
3-4 PM				
4-5 PM				
5-6 PM				
6-7 PM				
7-8 PM				
8-9 PM				
9-10 PM				
10-11 PM				
11 PM-Midnight				

Comments:

Seasonal Operation (Y / N)

If the operation of the facility changes by season and affects lighting use, describe the period of different operating hours (season)?

	From Month	From Day	Through Month	Through Day	Operating Hours From	Operating Hours To	HVAC Percent 0=Closed	Other Percent 0=Closed
Period 1	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __
Period 2	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __
Period 3	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __

Indoor Lighting

Color Rendition Critical? Y☐ N☐ Security Critical? Y☐ N☐ Light Levels Critical? Y☐ N☐ Footcandles _ _ _

Item #	T1	T2	Lamp Type	Control Type	Watts/ Lamp	Ballast Type	# of Lamps/ Fix	Sched. #	Number of Fixtures

Lamp Type Code

Code	Name	Code	Name	Code	Name	Code	Name	Code	Name
2F	2 Foot fluorescent	8F	8 foot fluorescent	I	Incandescent	L	Low Pressure Sodium	EI	Exit sign, Incandescent
3F	3 foot fluorescent	CF	Compact fluorescent	IR	Incandescent Elliptical Reflector	MV	Mercury Vapor	EF	Exit sign, Fluorescent
4F	4 foot fluorescent	UT	U-tubes	IS	Incandescent Spotlight	MH	Metal Halide	EL	Exit sign, LED
6F	6 foot fluorescent	OF	Other fluorescent	Q	Quartz	H	High Pressure Sodium		

Area Type Code

1	Office/Conference	7	Patient Room	13	Cooking	19	Gymnasium, Conditioned
2	Retail	8	Medical Examination Room	14	Laboratory	20	Industrial Processing, Cond.
3	Conditioned Storage	9	Operating or Intensive Care	15	Repair, Conditioned	21	Industrial Process., Uncond.
4	Unconditioned Storage	10	Classroom	16	Library	22	Other, Conditioned
5	Refrig. Storage (<60°F)	11	Hotel Room	17	Vacant, Conditioned	23	Other, Unconditioned
6	Dining Room	12	Public Assembly	18	Hallway/Lobby/Stair, Cond.		

T1: 1 = Recessed 2 = Suspended 3 =Wall 4 = Table/Floor 5 - Ceiling Mounted	Ballast type: 1 = Standard Magnetic 2 = High Efficiency Magnetic 3 = Electronic 4 = Hybrid

T2: 1 = Optical Reflectors 2 = Vented 3 = Both	Control type : 1 = On/Off Switch 2 = Time Clock 3 = Dimmer 4 = Occupancy Sensor 5 = EMS 6 = Photo Cell

Outdoor Lighting (Y / N)

Color Rendition Critical? Y☐ N☐ Security Critical? Y☐ N☐ Light Levels Critical? Y☐ N☐

Control type : 1 = On/Off Switch 2 = Time Clock 6 = Photo Cell

Item #	Lamp Type	Control Type	Watts/ Lamp	# of Lamps/ Fix	Use	Sched. #	Count	Total

Lamp Type Code

Code	Name	Code	Name	Code	Name
4F	4 Foot fluorescent	I	Incandescent	L	Low Pressure Sodium
6F	6 foot fluorescent	IR	Incandescent Elliptical Reflector	MV	Mercury Vapor
8F	8 foot fluorescent	IS	Incandescent Spotlight	MH	Metal Halide
CF	Compact fluorescent	Q	Quartz	H	High Pressure Sodium
UT	U-tubes	N	Neon	EI	Exit sign, Incandescent
OF	Other fluorescent			EF	Exit sign, Fluorescent
				EL	Exit sign, LED

Use Code

PL	Parking Lot
PG	Parking Garage
AD	Advertising
FA	Facade
O1	Other:_____
O2	Other:_____
O3	Other:_____

Lamp Types And Typical Wattages

Fluorescent		**Incandescent**	**Incandescent Spotlight**	**Compact Fluorescent**	**Quartz**	**Metal Halide**	**High Pressure Sodium**	**Mercury Vapor**	**Low Press. Sodium**
Standard 4 ft	40 Watts	15 Watts	30 Watts	9 Watts	75 Watts	75 Watts	35 Watts	40 Watts	35 Watts
Energy Saver 4 ft	34 Watts	20 Watts	50 Watts	10 Watts	100 Watts	150 Watts	50 Watts	50 Watts	55 Watts
T8 4 ft	32 Watts	25 Watts	75 Watts	13 Watts	150 Watts	175 Watts	70 Watts	75 Watts	90 Watts
High Output 4 ft	60 Watts	40 Watts	100 Watts	18 Watts	200 Watts	250 Watts	100 Watts	100 Watts	135 Watts
Very H.O. 4 ft	115 Watts	60 Watts	120 Watts	22 Watts	250 Watts	300 Watts	150 Watts	175 Watts	180 Watts
U-Tube 4 ft	40 Watts	75 Watts	150 Watts	24 Watts	300 Watts	325 Watts	200 Watts	250 Watts	
Standard 8 ft	75 Watts	100 Watts	200 Watts	26 Watts	350 Watts	400 Watts	250 Watts	300 Watts	
Energy Saver 8 ft	60 Watts	150 Watts	250 Watts	28 Watts	400 Watts	750 Watts	310 Watts	400 Watts	
High Output 8 ft	110 Watts	200 Watts	300 Watts	36 Watts	500 Watts	1000 Watts	360 Watts	700 Watts	
Very H.O. 8 ft	215 Watts	300 Watts	500 Watts		750 Watts	1500 Watts	400 Watts	1000 Watts	
		500 Watts	750 Watts		900 Watts		880 Watts		
		Incand. Ellips Reflectors	1000 Watts		1000 Watts		1000 Watts		
		50 Watts			1500 Watts				
		75 Watts							

	120 Watts						

Site _____ Date _____

Area One: _____ Page ___ of ___

Room Dimensions ___ feet x ___ feet

Light Level Measurements – Illumination in foot-candles (fc)

All Lights ON

1	2
3	4

All Lights OFF

1	2
3	4

Lighting Power Measurements

	Measurement Location Circuit Description or Panel & Breaker #	Volts	Amps	Watts	pf	Type of Fixtures	# of Fixtures	# of Burnt Lamps
1								
2								
3								
4								
5								

6								

Site _____ Date _____

Area Two:_____ Page ___ of ___

Room Dimensions ___ feet x ___ feet

Light Level Measurements – Illumination in foot-candles (fc)

All Lights ON

1	2
3	4

All Lights OFF

1	2
3	4

Lighting Power Measurements

	Measurement Location Circuit Description or Panel & Breaker #	Volts	Amps	Watts	pf	Type of Fixtures	# of Fixtures	# of Burnt Lamps
1								
2								
3								
4								
5								

6								

Site _____ Date _____

Area Three:_____ Page ___ of ___

Room Dimensions ___ feet x ___ feet

Light Level Measurements – Illumination in foot-candles (fc)

All Lights ON

1	2
3	4

All Lights OFF

1	2
3	4

Lighting Power Measurements

	Measurement Location Circuit Description or Panel & Breaker #	Volts	Amps	Watts	pf	Type of Fixtures	# of Fixtures	# of Burnt Lamps
1								
2								
3								
4								

5								
6								

Site _____ Date _____

Area Four: _____ Page ___ of ___

Room Dimensions ___ feet x ___ feet

Light Level Measurements – Illumination in foot-candles (fc)

All Lights ON

1	2
3	4

All Lights OFF

1	2
3	4

Lighting Power Measurements

	Measurement Location Circuit Description or Panel & Breaker #	Volts	Amps	Watts	pf	Type of Fixtures	# of Fixtures	# of Burnt Lamps
1								
2								
3								

4								
5								
6								

Notes